ON SOUND DISCRIMINATION IN DOGS.

By W. T. Shepherd

The present paper is a report of experiments made on dogs, to ascertain whether or not they are able to discriminate sounds; viz: differences of musical notes of different pitch. It seems fair to conclude that if an animal forms an association between a certain musical note and food, so that he reacts in a particular manner to that note to obtain food, and does not so react to other notes, he discriminates that note from the other notes.

The reader may recall that Kalischer[1] reported experiments on dogs on auditory discrimination. In those tests, positive results were obtained by him. His method was to sound a certain note on an organ or harmonium; the dog would thereupon react in a definite manner, e. g. springing up and snapping at a piece of meat held in the experimenter's hand. Selionyi,[2] using a form of the "Pawlow method," got evidence of discrimination by dogs of the tones of an organ, of organ pipes and of the sounds of two whistles. Both Kalischer and Selionyi were chiefly interested in sound discrimination from the standpoint of physiology. The present writer in experiments reported by Cole,[3] obtained evidence of the discrimination of pitch by raccoons. In experiments I made in 1909 on auditory discrimination in Rhesus monkeys,[4] evidence of such discrimination by the latter animals of pitch and also of "Noise" was obtained. I also obtained evidence of discrimination of musical pitch and also of "Noise" in experiments made with cats.[5]

In the experiments herein reported, two animals were tested. Both were female beadle dogs. One, Kate, was about

[1] Kalischer, O. Eine Neue Horprufungsmethode bei Hunden. Sitz. d. Kgl. Ak. d. Wiss, X. 1907, 204 ff.

[2] Selionyi, G. P., Contributions to the Study of the Reactions of the Dog to Auditory Stimuli. St. Petersburg, 1907.

[3] Cole, L. W., Concerning the Intelligence of Raccoons. Jour. Comp. Neur. and Psy. 17; 236.

[4] Shepherd, W. T., Some Mental Processes of the Rhesus Monkey, Psy. Rev. Mon. Sup. No. 52, 1910, 26 ff.

[5] Shepherd, W. T., On Sound Discrimination by Cats. Jour. of Animal Behavior, Vol. IV. No. 1, pp. 70-75. 1914.

a year old; the other, Maud was about 8 years old. The younger animal appeared to be the more intelligent, though neither seemed conspicuously so. As far as I am aware, neither dog had had any previous training in sound discrimination.

In these experiments, as in those on raccoons, monkeys and cats, I used a method somewhat similar to that employed by Kalischer. The dog was placed in a box with a wire netting at the front and on the top. I sat at a distance of a meter from the cage and sounded the note on the instrument. The animal was to rear up on the netting at the front of the cage at the sound of a certain note, or rather after, as high, be fed at that note, and not to rear up at the sound of the other note, as low, and not to be fed at the latter note. At the sound of the "Food note," the dog was given a morsel of food, whether or not it reared up at that note. At the other note, it was not fed. The stimulus was food; proper reaction was accepted as evidence of discrimination by the animals of difference of pitch of different notes. Ten seconds were allowed for response. In experiments I and II, an ordinary harmonica was used; in experiment III, an organ (Estey). In each test, care was taken not to give by looks, movements, expression or in any other manner, any inkling of the proper response. As a further control, in a part of the tests, the experimenter sat out of sight of the animals. Furthermore, in order that the dogs should not react to the mere *rhythm* of the sounds, the notes were sounded in an irregular order.

I. Discrimination of a Difference of Three Octaves of Pitch on a Harmonica A4 Food Note, A1 Non-Food Note.

Kate—On the 3d day, in the 41st trial in all, the animal first reacted correctly, in the 11th trial of 15 that day, i. e. 15 on each note. In that day's trial she seemed to *notice* and *watch,* somewhat, as if interested. No further indications were noted or evidence of any sense of difference of tones being distinguished by her until the 6th day. Then, she reared up at note A4 4 times in the 15 trials. The next day, she reacted to the high, A4 note, 5 times. On the 8th day, she responded correctly 6 times and incorrectly 5 times. On the 9th day, there were 7 correct reactions and 3 incorrect ones, i. e. 3 to A1. By the 11th day, of the 15 trials, there were 11 reactions to A4, and but 2 to A1. By the 24th day, or in 300 trials in all, the dog's discrimination was perfect. In the 10 trials of each auditory stimulus, 10 correct responses were given by her, and no responses to A1. She was then given a final "Test" of 10 trials of each note and made no errors.

Maud—The older dog, in 375 trials extending over many days, showed no definite indications of discrimination of the difference of three octaves of pitch. In a few trials of the 375, she reacted correctly, and in a few others gave reactions which may be regarded as doubtful, e. g. on a few occasions, though she did not rear up at A4, she *looked up,* and appeared to show some little indication of knowing the food note.

II. Discrimination of a Difference of One Octave of Pitch on a Harmonica. Fed at Low, A1.

Kate—In the first day's trials, upon changing the food note from A4 to A1, the record seems to show that Kate was puzzled. In 10 trials of the notes, she reacted to each 5 times. On the 3d day, she responded to A1 6 times and to A4 3 times; on the 4th day, to A1, 5 times and to A4 1 time. She was forming the association. On the 8th day, 80 trials of each sound in all, she was correct 9 times and wrong 1 time. On the 12th day, she made no mistakes. On the 14th day, right 9 times, wrong 1 time. 140 trials were made in all on each note in the one octave test. Kate did not seem to get this discrimination so nearly perfect as in the three octave test. Possibly, more trials would have so perfected her.

III. Discrimination of Three Octaves on an Organ; i. e. the Difference between F.1, Bass Clef and F.3 Clef.

In five days experiments of 10 trials each of each tone, daily, no evidence was obtained of discrimination of the notes. Neither were any indications observed of the beginning of such discrimination. While in some of the trials the animal reacted to one or the other of the notes, the record shows that in the last three days trials, 30 on each tone, no responses to either were obtained.

However, only 50 trials on each note were made in all, and it is quite possible that if many more than that number had been made, discrimination would have been shown. It required 300 trials in the first harmonica test and 140 in the second. Furthermore, it is but fair to bear in mind that the tests with the organ were made in the afternoon, while those with the harmonica were made in the forenoon, as it happened, and the dogs were usually fed at noon. Therefore, in the former case there not being present the stimulus of hunger as in the latter, we could hardly expect so much interest on her part, and so not such aptitude for discrimination. I believe that with further trials, under the same conditions of hunger as a stimulus, as in the harmonica tests, discrimination would here also have been shown.

From these experiments we may conclude that dogs, or at least some dogs, discriminate differences of musical pitch. Our record of Kate's work shows this. Furthermore, her looks, at the time, actions, etc., gave clear indications of such discrimination to any unbiassed observer, e. g. *Getting down quickly,* after getting up at the wrong note.

It may be of interest to compare our results here with those obtained with other animals. Kate required 300 trials to perfect her discrimination of a difference of three octaves of pitch. One of the cats required 90 and the other 45 trials for two octaves. The two raccoons required respectively 100 and 150 trials. Two Rhesus monkeys required only 30 and 40 trials respectively to discriminate two octaves difference. In each case only two individuals were tested. Therefore, conclusions as to comparative rapidity of forming associations, and ability of discrimination are not strictly warranted.